

Claims

What is claimed:

1. An apparatus for writing to memory cells comprising:
 - a write current generator for generating a write current that is coupled to the memory cells; and
 - a current regulator for selecting a magnitude of the write current generated by the write current generator that is based upon a minimal threshold magnitude of write current and a maximal threshold magnitude of write current.
2. The apparatus of claim 1, wherein the minimum threshold magnitude of write current is a magnitude of write current required to cause at least one test magnetic memory cell to switch.
3. The apparatus of claim 1, wherein the maximum threshold magnitude of write current is a magnitude of current required to cause half-select errors within at least one test magnetic memory cell.
4. The apparatus of claim 1, wherein the current regulator averages the minimal threshold magnitude of write current and the maximal threshold magnitude of write current.
5. The apparatus of claim 1, wherein the current regulator comprises an averaging counter.
6. A method of selecting a magnitude of a magnetic memory cell write current, comprising:
 - determining a minimal magnitude of write current for writing to a magnetic memory cell;

determining a maximal magnitude of write current for writing to the magnetic memory cell;

calculating the selected magnitude of magnetic memory cell write current based on the minimal magnitude of write current and the maximal magnitude of write current.

7. The method of selecting a magnitude of a magnetic memory cell write current of claim 6, wherein calculating the selected magnitude of magnetic memory cell write current based on the minimal magnitude of write current and the maximal magnitude of write current comprises averaging the minimal magnitude of write current and the maximal magnitude of write current.
8. The method of selecting a magnitude of a magnetic memory cell write current of claim 6, wherein the minimum magnitude of write current is a magnitude of write current required to cause at least one test magnetic memory cell to switch.
9. The method of selecting a magnitude of a magnetic memory cell write current of claim 6, wherein the maximum magnitude of write current is a magnitude of current required to cause half-select errors within at least one test magnetic memory cell.
10. The method of selecting a magnitude of a magnetic memory cell write current of claim 6, wherein averaging the minimal magnitude of write current and the maximal magnitude of write current is performed by an averaging counter.
11. The method of selecting a magnitude of a magnetic memory cell write current of claim 10, wherein a count value of the averaging counter determines the selected magnitude of the magnetic memory cell write current.
12. The method for determining a magnitude of a write current for a magnetic memory cell using an averaging counter comprising:

- incrementing a count value of the averaging counter until a minimum write current has been reached;
- doubling the count value within the averaging counter;
- continue incrementing the count value of the averaging counter until a maximum write current has been reached;
- halving the count value of the averaging counter;
- setting the magnitude of the write current based upon the count value of the averaging counter.

13. The method for determining a magnitude of a write current of claim 12, wherein incrementing a count value of an averaging counter until a minimum write current has been reached comprises:

- selecting a default hard axis write current;
- incrementing the averaging counter, thereby incrementing an easy axis write current until a magnetic orientation of a test memory cell changes states.

14. The method for determining a magnitude of a write current of claim 12, wherein doubling the count value within the averaging counter comprises:

- shifting bits one position to double the counter value, wherein the averaging counter includes a binary counter.

15. The method for determining a magnitude of a write current of claim 12, wherein continue incrementing the count value of the averaging counter until a maximum write current has been reached comprises:

- zeroing the hard axis write current;
- continue incrementing the binary counter until the test memory cell changes states.

16. The method for determining a magnitude of a write current of claim 12, wherein halving the count value of the averaging counter comprises:

shifting bits one position to halve the counter value, wherein the averaging counter includes a binary counter.

17. The method for determining a magnitude of a write current of claim 12, wherein setting the magnitude of the write current based upon the count value of the averaging counter comprises:
 - loading the count value of the averaging counter into a binary counter that drives a current digital to analog converter (iDAC).
18. The method for determining a magnitude of a write current of claim 12, wherein the minimum current is a magnitude of write current required to cause at least one test magnetic memory cell to switch.
19. The method for determining a magnitude of a write current of claim 12, wherein the maximum current is a magnitude of current required to cause half-select errors within at least one test magnetic memory cell.
20. The method for determining a magnitude of a write current of claim 12, wherein the write current that is magnetically coupled to at least one test magnetic memory cell includes a continuous series of pulses, in which the pulses alternate in polarity.
21. The method for determining a magnitude of a write current of claim 12, further comprising a test magnetic memory cell state detector for detecting a logical state of at least one test magnetic memory cell, an output of the test magnetic memory cell state detector being fed back to a write current generator.
22. The method for determining a magnitude of a write current of claim 12, wherein the write current comprises an easy axis write current and a hard axis write current.

23. A method for determining a magnitude of a write current for a magnetic memory cell, comprising:

- selecting a default hard axis write current;
- incrementing a averaging counter while incrementing an easy axis write current until a magnetic orientation of a test memory cell changes states;
- doubling the count value within the averaging counter;
- zeroing the hard axis write current;
- continue incrementing the averaging counter while continuing incrementing the easy axis current until the test memory cell changes states;
- halving the count value of the averaging counter; and
- loading the count value of the averaging counter into a binary counter so that the easy axis current is an average current;
- restoring the default hard axis write current.

24. An apparatus for generating a write current for a magnetic memory cell comprising:

- a write current generator for generating a write current, the write current being magnetically coupled to the magnetic memory cell;
- at least one test magnetic memory cell, the write current being magnetically coupled to the at least one test magnetic memory cell;
- wherein the write current generator includes;
 - an averaging counter for calculating the write current by averaging a minimum write current and maximum write current.

25. The apparatus for generating a write current of claim 24, wherein the write current generator further comprises a binary counter coupled to a current digital to analog converter for generating a write current, a magnitude of the write current generated by the current digital to analog converter being dependent upon a count value of the averaging counter.

26. The apparatus for generating a write current of claim 24, wherein the minimum current is a magnitude of current required to cause the at least one test magnetic memory cell to switch.
27. The apparatus for generating a write current of claim 24, wherein the maximum current is a magnitude of current required to cause half-select errors within the at least one test magnetic memory cell.
28. The apparatus for generating a write current of claim 24, wherein the write current being magnetically coupled to the at least one test magnetic memory cell includes a continuous series of pulses, in which the pulses alternate in polarity.
29. The apparatus for generating a write current of claim 24, further comprising:
 - a test magnetic memory cell state detector for detecting a logical state of the at least one test magnetic memory cell, an output of the test magnetic memory cell state detector being fed back to the write current generator.
30. The apparatus for generating a write current of claim 24, wherein the write current generator comprises an easy axis write current and a hard axis write current.
31. An array of magnetic memory cells, the array comprising an apparatus for generating a write current for writing to the magnetic memory cells, the apparatus comprising:
 - a write current generator for generating a write current, the write current being magnetically coupled to the magnetic memory cells;
 - at least one test magnetic memory cell, the write current being magnetically coupled to the at least one test magnetic memory cell;
 - wherein the write current generator includes:
 - a current digital to analog converter for generating the write current;
 - an averaging counter for calculating the write current by averaging a minimum write current and maximum write current, a count value of the

averaging counter determining a magnitude of the write current generated by the current digital to analog converter.

32. An apparatus for generating a write current for a magnetic memory cell comprising:

means for determining a minimal magnitude of write current for writing to the magnetic memory cell;

means for determining a maximal magnitude of write current for writing to the magnetic memory cell;

means for averaging the minimal magnitude of write current and the maximal magnitude of write current.